



# ENERGY STAR® Test Method for Small Network Equipment

**Final  
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## 1 OVERVIEW

The following protocol shall be followed when testing products for compliance with the Version 1.0 ENERGY STAR Small Network Equipment (SNE) specification.

## 2 APPLICABILITY

ENERGY STAR test requirements are dependent upon the feature set of the product under evaluation. The following guidelines shall be used to determine the applicability of each section of this document:

- Section 7.2.A) shall be conducted for all SNE products.
- Sections 7.2.B), C), and D) shall be completed for applicable product types as referenced in Table 1.

**Table 1: Test Procedure Structure**

Product Type	Test Procedure Section			
	7.2.A) All Devices – Idle State	7.2.B) Wired Network – WAN	7.2.C) Wired Network – LAN	7.2.D) Wireless Network – LAN
Modem (DSL, Cable)	X	X		
Optical Network Termination Device (ONT)	X	X		
Integrated Access Device	X	X	X	X
Switch/Router	X		X	Routers with Wireless
Access Point	X			X

## 3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions contained in the ENERGY STAR Eligibility Requirements for Small Network Equipment.

Acronyms referenced in this ENERGY STAR Test Method draft:

- ANSI: American National Standards Institute

- AP: Access Point
- dB: Decibels
- DHCP: Dynamic Host Configuration Protocol
- DSL: Digital Subscriber Line
- EIA: Electronic Industries Alliance
- EPS: External Power Supply
- HPNA: Home Phoneline Networking Alliance
- IAD: Integrated Access Device
- IEC: International Electrotechnical Commission
- IEEE: Institute of Electrical and Electronics Engineers
- IMIX: Internet Traffic Mix
- IPsec: Internet Protocol Security
- ISP: Internet Service Provider
- L2TP: Layer 2 Tunneling Protocol
- LAN: Local Area Network
- LLDP: Link Layer Discovery Protocol
- MAC: Media Access Control
- MIMO: Multiple-Input/Multiple-Output
- MoCA: Multimedia over Coax Alliance
- MTU: Maximum Transmission Unit
- NAT: Network Address Translation
- ONT: Optical Network Terminal
- PoE: Power over Ethernet
- PON: Passive Optical Network
- POTS: Plain Old Telephone Service
- PPPoX: Point-to-Point Protocol over X
- RF: Radio Frequency
- SSID: Service Set Identifier
- TIA: Telecommunications Industry Association
- TTL: Time To Live
- UDP: User Datagram Protocol
- USB: Universal Serial Bus
- UUT: Unit Under Test
- VoIP: Voice over Internet Protocol
- VPN: Virtual Private Network

- WAN: Wide Area Network
- WLAN: Wireless Local Area Network

## 4 TEST SETUP

- A) Test Setup and Instrumentation: Test setup and instrumentation for all portions of this procedure shall be in accordance with the requirements of IEC 62301, Ed. 2.0, "Household electrical appliances – Measurement of standby power", Section 4, "General Conditions for Measurements". In the event of conflicting requirements, the ENERGY STAR test method shall take precedence.
- B) Input Power: Input power shall be as specified in Table 2.

**Table 2: Input Power Requirements**

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
North America, Taiwan	115 Vac	+/- 1.0 %	2.0 %	60 Hz	+/- 1.0 %
Europe, Australia, New Zealand	230 Vac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
Japan	100 Vac	+/- 1.0 %	2.0 %	50 Hz or 60 Hz	+/- 1.0 %

- C) Ambient Temperature: Ambient temperature shall be from 18 °C to 28 °C.
- D) Relative Humidity: Relative humidity shall be from 10% to 80%.
- E) Power Meter: Power meters shall possess the following attributes:
- 1) Crest Factor: Capability to measure the current waveform without clipping.
    - i) The peak of the current waveform measured during Idle State shall determine the crest factor rating requirement and the appropriate current range setting.
    - ii) The full-scale value of the selected current range multiplied by the crest factor for that range shall be at least 15% greater than the peak current.
  - 2) Bandwidth: Minimum bandwidth as determined by an analysis of current and voltage to determine the highest frequency component (harmonic) with a magnitude greater than 1% of the fundamental frequency under the test conditions.
  - 3) Minimum Frequency Response: 3.0 kHz
  - 4) Minimum Sampling Frequency: 60 Hz

5) Minimum Resolution:

- i) 0.01 W for measurement values less than 10 W;
- ii) 0.1 W for measurement values from 10 W to 100 W; and
- iii) 1.0 W for measurement values greater than 100 W.

6) Measurement Accuracy:

- i) Power measurements with a value greater than or equal to 0.5 W shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level.
- ii) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W at the 95% confidence level.

## 5 TEST CONDUCT

- A) As-shipped Condition: Products must be tested in their “as-shipped” configuration. For products that offer a choice of user-configurable options, all options shall be set to their default condition, unless otherwise specified in this test procedure.
- B) Test Procedure Order: All portions of this test method shall be followed in the order in which they are written.
- C) Data Source/Transfer Requirements: Commercially available traffic generators are not required to generate traffic, provided the chosen hardware and software used for testing meet the criteria below. An example software script to generate traffic for testing can be found [here](http://endusefiles.lbl.gov/public/energystar_sne/sne_traffic_gen.tar.gz).<sup>1</sup> Traffic generators used for testing shall be configured for the correct traffic topology and traffic profile, and as follows:
  - 1) All data transfers shall occur via User Datagram Protocol (UDP).
  - 2) The “data rate” is the average number of bits per second passing over a link in one direction. Data rates are expressed as the average number of bits found in UDP data frames passing over a link in a one second period.
  - 3) The traffic generator shall be able to support the maximum theoretical data rate of the unit under test (UUT) with UDP traffic.

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<sup>1</sup> [http://endusefiles.lbl.gov/public/energystar\\_sne/sne\\_traffic\\_gen.tar.gz](http://endusefiles.lbl.gov/public/energystar_sne/sne_traffic_gen.tar.gz) - Developed by the Lawrence Berkeley National Laboratory for optional use in the Version 1.0 ENERGY STAR Small Network Equipment Test Method

- 4) The 1 kb/s data rate test traffic used for qualification shall contain random data in a variety of datagram (or frame) sizes based on an Internet traffic mix (IMIX) sent at random intervals. For the high data rate test traffic, frame size may be increased up to the maximum transmission unit (MTU) as needed to sustain the high data rate traffic. See references in Table 3 for more information.
- 5) Data shall be evenly split between both directions (transmission and reception) for a given link unless otherwise specified in this test procedure.
- 6) Port numbers for data traffic shall be randomly selected in advance of each test from the available pool of valid UDP ports. Once selected, port numbers shall not be changed for the duration of testing. If the selected port results in blocked traffic by a UUT firewall, select a different port at random before proceeding with the test.

**Table 3: Data Source/Transfer References**

Reference	Description
<a href="http://spcprev.spirentcom.com/documents/4079.pdf">http://spcprev.spirentcom.com/documents/4079.pdf</a>	<u>Spirent</u> , Test Methodology Journal, IMIX (Internet Mix) Journal, March 2006
<a href="http://www.ixiacom.com/library/test_plans/display?key=testing_pppox">http://www.ixiacom.com/library/test_plans/display?key=testing_pppox</a>	<u>IXIA Library</u> : Test Plans, Broadband PPPoX and L2TP Testing

- D) Battery Operated Products: For products designed to operate using batteries either when not connected to the mains or during a power disruption, the battery shall be fully charged before the start of testing and shall be left in place for the test. To ensure the battery is fully charged, perform the following steps:
- 1) For UUTs that have an indicator to show that the battery is fully charged, continue charging for at least an additional 5 hours after the indication is present.
  - 2) If there is no charge indicator, but the manufacturer's instructions provide a time estimate, continue charging for at least an additional 5 hours after the manufacturer's estimate.
  - 3) If there is no indicator and no time estimate in the instructions, but the charging current is stated on the UUT or in the instructions, terminate charging 1 hour after the calculated charge duration or, if none of the above applies, the duration shall be 24 hours.

## 6 UUT CONFIGURATION

### 6.1 Supplied Power Configuration

A UUT that can be powered by either mains power or low-voltage dc shall be powered from the mains.

- 1) Mains-powered: If the UUT is shipped with an external power supply (EPS), or powered directly by mains ac, power consumption of the UUT shall be measured and tested between the ac power source and the UUT.

### 6.2 Wired Port UUT Configuration

Only Ethernet ports are considered wired local area network (LAN) ports for purposes of testing. Ethernet connectivity and all other wired ports shall be configured for testing as follows:

- 1) Peripheral Devices: Non-Ethernet wired ports (e.g., HPNA, MoCA, USB, analog connections, POTS, audio) shall not be connected, unless a secondary device and cable are shipped with the UUT (e.g., an external disk with a USB connection).
- 2) Network Link Maintenance: The UUT's wide area network (WAN) port shall be connected to a live source. Network links shall be continuously maintained, with the exception of brief lapses when transitioning between link speeds.
- 3) Ethernet Port Connection Rate: Ethernet ports shall be connected at the maximum supported link rate unless otherwise specified in this test procedure.
- 4) Ethernet Cabling: All Ethernet cables used for testing shall meet ANSI/EIA/TIA-568 Category 5e (Cat5e) specifications and shall be between 1 and 2 meters in length.
- 5) Power over Ethernet: PoE capability shall be configured with default as-shipped settings.
- 6) Efficient Networking Protocols:
  - i. If the UUT supports IEEE 802.3az protocol, all connected devices must support IEEE 802.3az,
  - ii. If the UUT supports Link Layer Discovery Protocol (LLDP) for 802.3az, all connected devices must support LLDP for 802.3az.

### 6.3 Wireless UUT Configuration

The UUT shall be tested with wireless network settings in their default as-shipped configuration. Default settings shall not be modified unless modification is necessary to complete this procedure, or if no default setting exists. Any features that require special configuration to achieve intended function (e.g., initial setup before use as indicated in a reference manual) shall be configured per the following requirements. If additional required settings are not listed below, the setting type and option shall be recorded in the test report.

- 1) SSID: As-shipped, or assigned a random value as required by the UUT;
- 2) Network Encryption: As-shipped, or 128-bit WPA2 as required by the UUT;
- 3) Network Key: As shipped, or assigned a random value as required by the UUT;
- 4) Network Channel: A supported channel shall be selected and maintained for the duration of testing;
- 5) Interference Mitigation: Interference robustness or other interference mitigation technology shall be as-shipped or set to "ON" if configuration required by UUT.
- 6) Wireless Link Precedence:
  - i) *Single instantaneous frequency band support*: The first supported wireless standard and frequency band starting from the top of Table 4 shall be used for Access Point testing. Only one band shall be active during the test.

**Table 4: Wireless Link Precedence - Single Instantaneous Frequency Band Support**

Wireless Band	Frequency
IEEE 802.11ac	5 GHz (Maximum supported channel bandwidth)
IEEE 802.11n	5 GHz (Maximum supported channel bandwidth)
IEEE 802.11n	2.4 GHz (20MHz channel bandwidth)
IEEE 802.11g	2.4 GHz
IEEE 802.11b	2.4 GHz
IEEE 802.11a	5 GHz

- ii) *Simultaneous instantaneous frequency band support.* The first supported pair of wireless standards and frequency bands starting from the top of Table 5 shall be used for access point testing.

**Table 5: Wireless Link Precedence - Simultaneous Instantaneous Frequency Band Support**

Wireless Band 1	Frequency 1	Wireless Band 2	Frequency 2
IEEE 802.11n	2.4 GHz (20 MHz channel bandwidth)	IEEE 802.11ac	5 GHz (Maximum supported channel bandwidth)
IEEE 802.11n	2.4 GHz (20 MHz channel bandwidth)	IEEE 802.11n	5 GHz (Maximum supported channel bandwidth)
IEEE 802.11g	2.4 GHz	IEEE 802.11n	5 GHz (Maximum supported channel bandwidth)
IEEE 802.11g	2.4 GHz	IEEE 802.11a	5 GHz
IEEE 802.11b	2.4 GHz	IEEE 802.11a	5GHz

- iii) *Alternative configurations:* If a device cannot support any configuration listed in either Table 4 (for support of a single instantaneous frequency band) or Table 5 (for support of multiple instantaneous frequency bands), the test client shall provide a configuration. The configuration shall be recorded in the test report.

## 6.4 UUT Wired Network Settings

The UUT shall be tested with wired network settings in their default as-shipped configuration. Default settings shall not be modified, unless otherwise specified in this test method or if no default setting exists. Any features that require configuration prior to the UUT functioning (e.g., required setup before use as indicated in a reference manual) shall be configured per the following requirements. If additional required settings are not listed below, the setting type and option shall be recorded in the test report.

- 1) Enable Network Address Translation (NAT) for IPv4 networks;
- 2) Enable IPv6 Link Local, Neighbor Solicitation, Neighbor Discovery, Router Solicitation and Router Advertisement;
- 3) Enable Single Class C Subnet;
- 4) Enable single hop (router TTL + 1) to source on WAN side;
- 5) Enable DHCP, if available, and have the UUT autonomously assign each configured test client an address by the DHCP service in the router, or manually assign addresses in a manner typical of DHCP (e.g., incremental, 3 day TTL); the WAN port shall be configured via DHCP or manually assigned if DHCP is not supported;
- 6) Disable Internet Protocol Security (IPsec);
- 7) For any wired network interface connected for testing as required by this Test Method, the interface shall be configured in full compliance with the relevant published or draft standard governing the technology (e.g., all features comply with IEEE 802.3);
- 8) If the UUT offers more than one WAN connection option, the UUT shall be configured using the first available WAN connection presented in
- 9) Table 6, from top to bottom. Only a single WAN port shall be connected.
- 10) The WAN connection shall be configured to operate at the maximum possible speed.

**Table 6: WAN Link Precedence**

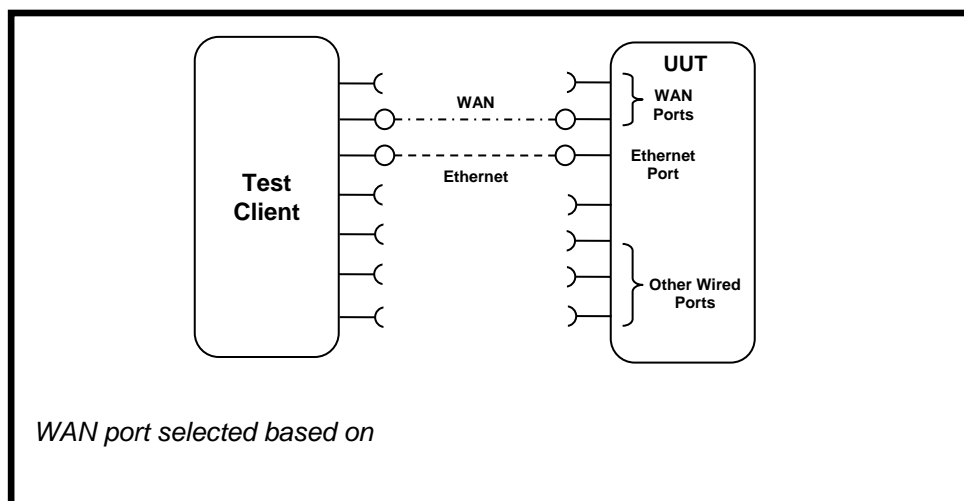
Connection Type	Media Type
DOCSIS (Cable)	Coax
PON	Fiber
DSL	Copper (Twisted Pair)
Ethernet (IEEE 802.3)	Copper (Twisted Pair)

## 6.5 UUT Preparation

The UUT shall be configured for testing as follows.

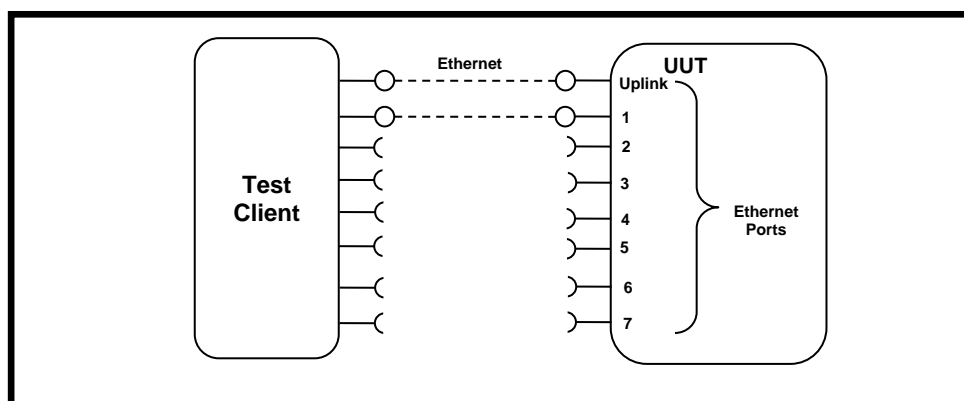
- 1) Test Report: Record the manufacturer and model name of the UUT. Record all basic information about the UUT's configuration including, but not limited to, the settings listed Sections 6.1 through 6.4.
- 2) Network Connection: Connect the UUT to network resources as follows:
  - i) Modem (DSL, Cable, or ONT): See Figure 1: Modem setup.





**Figure 1: Modem setup.**

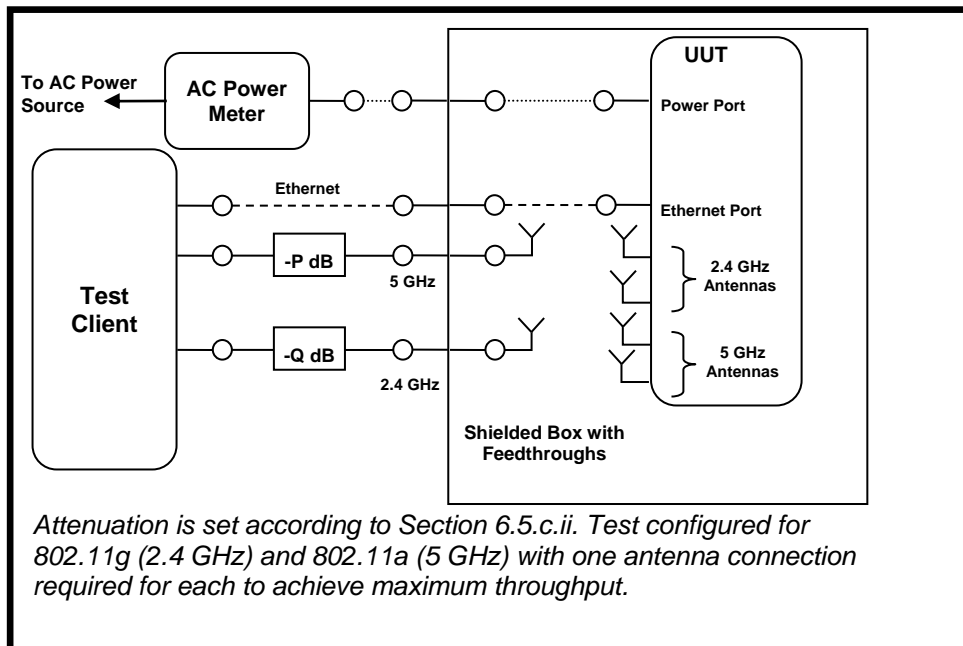
- (a.) Connect the UUT WAN port to the test client using the priority and link rate specified in Section 6.4.
  - (b.) Connect one LAN port to the test client. If Ethernet is available, the Ethernet port shall be used. If more than one Ethernet port is present, the first non-uplink Ethernet port shall be used.
- ii) Switch/Router: See Figure 2: Switch or router test setup.



**Figure 2: Switch or router test setup.**

- (a.) Connect two of the UUT's available ports to the test client and ensure that live links are maintained for the duration of testing on all connections.
  - (b.) If there is a port on the UUT identified as the uplink or WAN port, it shall be selected as one of the two ports connected for testing. Otherwise, the first port shall be used as the uplink port.
  - (c.) *For Wireless Router Testing:* see setup in section 6.5D)3)iii)(c.)
- iii) IAD or Access Point:

- (a.) *Access Points*: Connect the uplink Ethernet port to the test source at the highest available link rate and ensure that live links are maintained for the duration of testing.
- (b.) *IADs*: Ensure a WAN port is connected according to the priority specified in Section 6.4 and ensure that live links are maintained for the duration of testing. Connect the first Ethernet port to the test source at the highest available link rate. Traffic for this test will pass over the Ethernet link and not the WAN link.
- (c.) *Wireless UUTs*: (see Figure 3: AP setup with fixed antennas.).
  - (i.) Place the UUT inside a shielded enclosure large enough to fit the UUT without contact with enclosure walls. The enclosure must have sufficient RF absorbing material lining all inside surfaces and also have sufficient RF, Ethernet, and power feed-throughs to service the UUT.
  - (ii.) Connect antennas to the RF feed-throughs on the inside of the enclosure.
  - (iii.) Connect cables to the exterior feed-throughs via appropriate RF attenuators to achieve a signal strength of  $-50 \text{ dBm} \pm 5 \text{ dB}$ . The test client transmit power shall be set to ensure that the received signal strength at the UUT is  $-50 \text{ dBm} \pm 5 \text{ dB}$ , with received signal strength measured within the bandwidth of interest. Use of RF test equipment (e.g., spectrum analyzer) to determine the appropriate use of attenuation is recommended. The model names and numbers of equipment used shall be recorded.
  - (iv.) If the UUT has multiple antennas for a single band, an appropriate number of cables and antennas shall be connected to achieve the maximum supported data rate (i.e., 1 cable/antenna for 802.11a/b/g and  $\geq 1$  cable/antenna for 802.11n).



**Figure 3: AP setup with fixed antennas.**

- (d.) If the UUT requires an access point controller for normal operation, an access point controller from the same manufacturer as the UUT shall be added to the network for testing. If the UUT is capable of full operation without an access point controller, it shall be tested without a controller on the test network.

- (e.) Record sufficient details of the test setup to allow for the test to be independently re-created and verified.

3) Power Meter Connection:

- i) Connect the power meter(s) to an ac voltage source set to the appropriate voltage and frequency for the test.
- ii) Plug the UUT into the measurement power outlet on the power meter, as follows:
  - (a.) No other devices (e.g., power strips or UPS units) may be connected between the meter and the UUT;
  - (b.) If the UUT uses an EPS, the EPS is considered part of the UUT. Plug the EPS input into the measurement power outlet on the meter;
  - (c.) The power meter shall remain connected until all testing is complete.

## 6.6 Test Client Setup

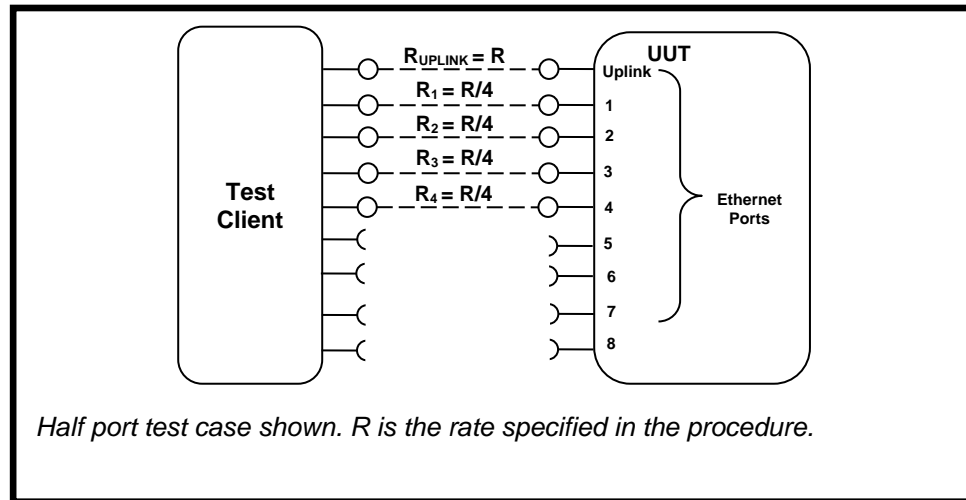
The tests outlined in Section 7 require the use of network tester equipment (the test client) capable of supporting the protocols used during testing. The test client may consist of several discrete pieces of test equipment used together to test Ethernet, WAN, and wireless links. This section is intended to provide guidelines for test client configuration to be applied to the specific pieces of equipment serving the UUT.

- 1) Configure the test client Ethernet ports to be DHCP clients with unique, random MAC addresses.
- 2) Configure the WAN port or uplink Ethernet port to assign a random IPv4 address to the UUT. A static IPv4 address may be set in the UUT if the test client is unable to support random address assignment. IPv6 may be used if IPv4 support is not present in the test client hardware. If the UUT is configured for DHCP pass-through functionality, the test client shall assign addresses through the UUT.
- 3) Configure the test client to send traffic using UDP.
- 4) Configure the test client to provide statistics on data reliability (% of packets received successfully).
- 5) Configure the test client to transmit variable length packets or frames using the basic IMIX given in Table 7 (see Table 3 for references). The packet content shall be random as specified in Section 5.C).4).

**Table 7: IMIX Packet Length Distribution**

Datagram Size (IP Length in Bytes)	Frame Length (Bytes)	% of total packets
40	64	61%
576	594	23%
1500	1518	16%

- 6) Configure the test client to test in a modified aggregation mode. All traffic will pass over a single link (the uplink or WAN port), and this traffic will be evenly divided between the other connected Ethernet ports. See Figure 4: Data distribution for multilink tests.



**Figure 4: Data distribution for multilink tests.**

- 7) If the UUT has wireless capability, the test client shall be capable of functioning as a wireless client for the wireless standard(s) specified in Section 6.3.
- 8) Configure data connections to the test client as specified in Section 6.5.
- 9) Record the model names and numbers of test equipment used for the test client and provide a functional diagram of the test equipment and UUT configuration, including all connections in the test setup.

## 7 TEST PROCEDURES FOR ALL PRODUCTS

## 7.1 Power Measurement Guidelines

- A) Tests are performed at two data rates, 1 kb/s (0.5 kb/s in each direction), and the highest rate supported by the link shown in Table 8. The 1 kb/s rate shall be achieved as a moving average, where the data rate averages 1 kb/s, +/- 50%, in any 30 second window. If the link has asymmetric data rate support (e.g., DSL, with a higher download rate than upload rate), choose the highest rate supported for the direction shown in the table. For data rates higher or lower than those shown in the chart, choose the highest data rate according to Equation 1 and adjusting the variable Y as required to achieve the desired data rate. The high data rate shall be achieved as a moving average, where the data rate averages the rate as determined in Table 8, +/- 10%, in any 30 second window. **Note:** A link with 100 Mb/s PHY throughput will not support 100 Mb/s of traffic as specified in this procedure. In this case the traffic rate should be set to 50 Mb/s.

### Equation 1

$$DataRate = Z \times 10^Y \text{ (in bits per second)}$$

Where:

- *Z is 1, 2, or 5, and*
- *Y is an integer. Adjust as required to achieve the desired data rate*

**Table 8: Test Rate Selection**

Direction	Rate (Mb/s)								
Downlink or Symmetric link	1.0	2.0	5.0	10	20	50	100	200	500
Uplink	0.5	1.0	2.0	5.0	10	20	50	100	200

- B) If there is a port on the UUT identified as the uplink or WAN port, it shall be selected as the uplink port in Section 7.2.C). Otherwise, the first port shall be used as the uplink port. If present, additional Ethernet ports shall be connected sequentially, and there shall be no open Ethernet ports between occupied Ethernet ports.
- C) If any standard power reduction mechanisms are supported by the UUT, such features may be enabled during testing in both the UUT and test equipment, provided that all enabled features are disclosed along with reported test results.
- D) The following procedure shall be used for each test component in Section 7.2:
- 1) Reset the power meter (if necessary).
  - 2) Begin recording elapsed time.
  - 3) After 5 minutes have elapsed, set the meter to begin accumulating true power values at a rate of greater than or equal to 1 Hz (1 reading per second).
  - 4) Accumulate power values for 5 minutes and record the average (arithmetic mean) value observed during the 5 minute period.
  - 5) Record the test procedure step and measurements on the test report. If a step is repeated at a different link rate, record the additional measurements in the test report.

## **7.2 Power Consumption Tests**

### **A) All Devices – Idle State**

- 1) Turn on the UUT and configure the UUT per the requirements in Section 6.
- 2) Measure and record UUT power per Section 7.1.

### **B) Wired Network – WAN**

- 1) If the UUT only supports WAN connection (IADs only), connect one Ethernet port. Ensure all Ethernet ports are connected at their highest supported link rate. Measure and record power per Section 7.1.
- 2) Run data at 1 kb/s (0.5 kb/s in each direction) between the WAN and LAN ports. Measure and record power per Section 7.1.

- 3) Run data at the rate specified in Section 7.1 between the WAN and LAN ports. Measure and record power per Section 7.1.

C) Wired Network – LAN:

- 1) Half-Ports Test: Test with half of ports in use, at all supported speeds, as applicable. See Figure 4: Data distribution for multilink tests.
  - i) If the UUT has more than two Ethernet ports, connect half of the Ethernet ports (round up to the nearest whole number of ports). Connect each port sequentially (e.g., a 5-port product would have ports 1-3 connected and ports 4 and 5 disconnected). Ethernet and other LAN ports on the UUT must be connected at their highest supported link rate. If a port on the UUT is specified as the uplink port, it shall be used as the uplink port for testing; otherwise, the first port shall be used as the uplink port. Measure and record power per Section 7.1.
  - ii) Run data at 1 kb/s (0.5 kb/s in each direction) between the LAN ports. Measure and record power per Section 7.1.
  - iii) Run data at the rate specified in Section 7.1 between the LAN ports. Measure and record power per Section 7.1.

D) Wireless Network - WLAN

- 1) Ensure only one Ethernet port is connected to the UUT.
- 2) Establish a single client device in the test client. The wireless local area network (WLAN) type must be consistent with the priority specified in Section 6.3 and shall be configured for the highest supported link rate. Record the supported rate for the network port, the wireless link, and the version of 802.11 being used for this test. Measure and record power per Section 7.1.
- 3) Run data at 1 kb/s (0.5 kb/s in each direction) between the LAN port and the WLAN client. Measure and record power per Section 7.1.
- 4) Run data at the rate specified in Section 7.1 between the LAN port and the WLAN client. Measure and record power per Section 7.1.

## 8 REPORTING

### 8.1 Reported UUT information and Functionality

The following characteristics are recommended for reporting using this procedure:

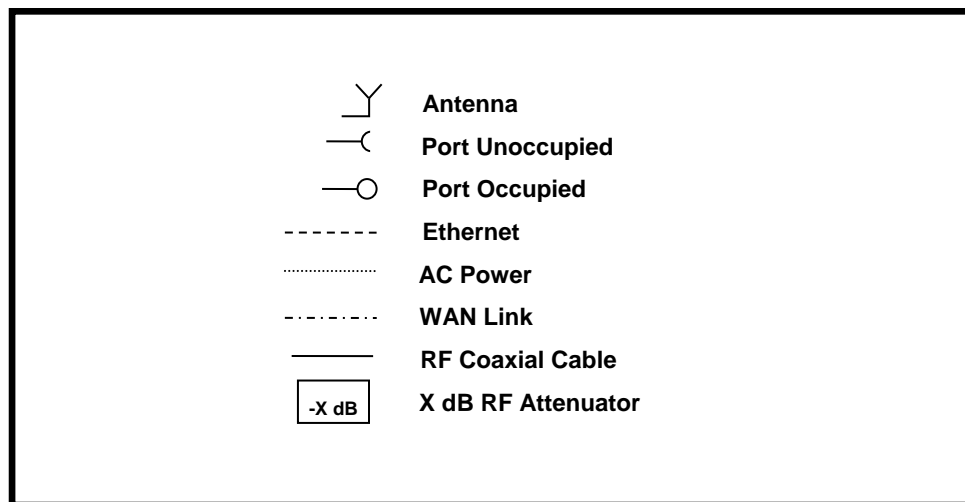
1. Manufacturer and model name;
2. Basic configuration information;
3. Powering options (e.g., direct ac, external ac-dc power supply, standard low-voltage dc). If powered over Ethernet, report whether LLDP for PoE is supported;
4. Number and type of all wired data and network ports. Additional related details (e.g., Ethernet speed, 802.3az, LLDP for 802.3az);
5. Number and type of wireless network support including supported bands, simultaneous band support, supported standards, and MIMO configuration. Additional details as required;
6. Supported network traffic functions (e.g., firewall, VPN, VOIP functionality for POTS ports);

7. Mass storage options integral to or shipped with the UUT;
8. Any special equipment ratings (e.g., IEC 61850 / IEC61000 and IEEE1613, KEMA).
9. Ethernet throughput - Maximum data rate in UDP data payload (expressed in b/s);
10. Maximum wireless clients;
11. Maximum NAT clients.

## 8.2 Reported Test Results

1. Voltage and frequency used in test;
2. If low-voltage dc, type of supply used;
3. Wireless Link information from Table 4 or Table 5;
4. Any settings changed per Section 6.4;
5. Uplink link rate;
6. Uplink and downlink data rates;
7. Power levels - Report all that apply:
  - One port: Idle State, low data rate, high data rate;
  - Half ports: Idle State, low data rate, high data rate;
  - Wireless: Idle State, low data rate, high data rate;

## 9 TEST CONFIGURATION REFERENCES



**Figure 5: Legend for all figures.**